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Trade among BRICS countries: Changes towards closer cooperation?

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Abstract

Recent developments in the world economy have led to a new concept of international relations where emerging markets, notably BRICS (Brazil, Russia, India, China and South Africa) economies, create a strong counterweight to the already existing world powers of the Triad (US, EU and Japan) in both economic and political areas. This results from the reallocation of global economic activities, global consumption to emerging and developing countries and hence import/export destination shifts. BRICS economies can be described today as being highly integrated into international trade, thus enhancing their engagement in the world economy. Even though the Triad remains among the most important trade partners for BRICS, their total share in BRICS's trade is decreasing. This paper examines changing geographical trade patterns of BRICS's exports in regard to significant changes in global trade shifts within the past decade. The aim of the paper is to identify product groups that are involved in BRICS's trade relations development and show possible diversions. The assessment focuses on regional trade orientation among BRICS themselves and between BRICS and the Triad. The results are further tested on the consistency of the countries' revealed comparative advantage together with the assessment of export trade introversion, complementarity and trade barriers. The results indicate that BRICS's exports to markets other than the Triad are increasing but consist of less significant product groups. The export intensity assessment provided rather independent evidence of BRICS's current behaviour than BRICS as a group. The most significant trade diversion from the Triad to BRICS was identified for the *Mineral fuels, oils, distillation products, etc.* product group exported by Brazil and South Africa to China and India.

Keywords

BRICS, complementarity, export introversion, regional orientation, RCA, tariffs, trade, trade diversion.

JEL Classification: F13, F14, F15, F47

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1. Introduction

Recent developments in the world economy have led to a new concept of international relations where emerging markets, notably BRICS (Brazil, Russia, India, China and South Africa) economies, create a strong counterweight to already existing world powers (the US, the EU and Japan) in both economic and political areas. This results from the reallocation of global economic activities and global consumption to emerging and developing countries and hence import/export destination shifts. BRICS's current geopolitical power was enhanced by the establishment of the newly coined acronym BRIC by O'Neill (2001) nearly a decade ago and by the long-term forecasts published by Wilson and Purushothaman (2003) from Goldman Sachs Investment Bank. It is expected that large BRICS economies with more than 40% of the world's population, and extensive demand, will be the engines of future global trade and economic growth. Therefore, their cooperation can also enhance their economic development. As a reaction, BRICS countries established a non-formal group, and since 2009, they have been meeting at yearly summits that serve as a promotional and network platform for their relations. The fifth BRICS summit talks in Durban, in 2013, confirmed an ongoing effort to further enhance BRICS's mutual relations and cooperation (*Fifth BRICS Summit,* 2013). This is in concordance with current world trade trends – substantially increasing trade among developing and emerging countries, thus as Nayyar (2008) states, enhancing their engagement in the world economy. Even though, the US, the EU, and Japan remain among the most important trade partners for BRICS, their total share in BRICS's trade is decreasing. As Keeler (2012) points out, trade between BRIC countries and North America, Europe and Japan has grown by 300% in the past 10 years, while trade among BRIC economies plummeted during the same time period by 1000%. Moreover, it is likely to expect further positive trade development among BRICS themselves. According to Gale (2012), BRIC economies currently trade with each other to the value of $307 billion. However, by 2015 this is estimated to reach a value of $500 billion, and it might be even more if South Africa is taken into consideration. Nevertheless, China plays an eminent role in current bilateral trade relations between BRICS. Regarding this, Gale (2012) mentions the recently signed trade and investment agreement worth $1 billion between China and Brazil. Furthermore, China also plans to increase mutual trade with India to $100 billion by 2015, and it continues to trade with Russia in areas of energy and oil. Other bilateral relations between BRICS are strengthening but to a lesser extent.

The faster development of mutual BRICS's relations is hindered by the aims of these countries to gain or maintain economic/political power, at least regionally, and by their own specific internal challenges. Thus, this makes it difficult to create close relations with each other. There is no single mutual preferential trade agreement (PTA) among BRICS. BRICS's economic relations are based solely on bilateral or trilateral PTAs such as the MERCOSUR and India's regional trade agreement (RTA); the Asia-Pacific Trade Agreement (APTA), where India and China are member countries; and the RTAs among Brazil, India and South Africa.

This study elaborates on these international trade trends. The aim of the paper is to identify product groups that are involved in BRICS's trade relations development and show possible diversion (i.e. more effective producers are replaced by less effective ones), arising from global trade shifts. This could indicate production inefficiencies stemming from PTAs and tariff reductions. The results explain whether the rising trade activity and closer BRICS's cooperation is truly based on their revealed comparative advantage (RCA) or whether some trade distortion occurs.

The assessment compares export trade intensities between BRICS in comparison to their trade ties with the rest of the world (export introversion), complementarity and mainly regional trade orientation among BRICS themselves and between BRICS and the Triad (the EU, the US and Japan). The results are further tested on the consistency of the countries' RCA together with the assessment of trade barriers.

The structure of the paper follows with the literature review. The next chapter elaborates the applied methodology stemming from previous research and data collection. The main assessment follows after-

ward and provides an overview of BRICS's export trends at the BRICS group level as well as at the level of each country. Export introversion, complementarity and trade diversion (identification of inefficient trade patterns) are included in the following chapter. The last chapter covers applied tariffs and discusses a possible explanation for the existing main trade diverting product groups. The conclusion is wrapped up in the last few paragraphs of the paper.

2. Literature review

BRICS economies have already been strengthening their positions in the current global world for a decade now and have been justifying their existence. This has naturally transmitted into a rising interest from academia and it has been reflected on in contemporary international trade research. On one hand, there have been studies of traditional bilateral trade relations and already existing integration groups such as the analysis of ASEAN and its bilateral trade intensity with India and ASEAN plus 3 (China, Japan and Korea) discussed by Chandran (2010) and Kim (2002), respectively. On the other hand, a number of researchers have been focusing on BRICS's intra and extra trade analysis in general and/or with a special focus on one of the countries in relation to the rest of the group. The latest research devoted to BRICS's trade analysis was by Havlik et al. (2009), De Castro (2012a, 2012b), Singh et al. (2011), Yuan and Zhao (2011), Çakir and Kabundi (2011) and Sharma and Kallummal (2012).

Havlik et al. (2009) assesses BRIC's and the Triad's (mainly the EU) trade in goods and services elaborating on their global trade positions, geographical and sectoral trade compositions and RCAs. The paper's findings show a shrinking Triad global market share as well as their share in the BRIC's market. It has been proven that the EU still plays a substantial role in the BRIC's trade especially by being Russia's main export partner and China's import partner. From an industrial competitiveness point of view, only China can represent a possible threat for the EU's producers. In terms of GDP shares, trade in services represents a minor but an increasing role in BRICS economies. Their services exports showed faster growth rates in comparison to the Triad's exports.

The trends in bilateral EU–BRIC trade were also studied by De Castro (2012a, b) with an evaluation of various trade indices such as RCA, trade intensity, complementarity, similarity and trade introversion. Similar research including further indices such as market share, regional orientation and competitiveness was also elaborated by Singh et al. (2011). This analysis discusses the idea of BRICS forming a union under a PTA. According to the findings, improving indices for most of the BRICS advocate the establishment of such a PTA among the five countries.

Yuan and Zhao (2011) assess BRIC's foreign trade from the perspective of a comparative, statistical and historical analysis. The study focuses on trade in goods, and among others, on its composition and destination market discussion with special implications on China. The analysis shows quite high trade dependencies for BRICS (led by China in contrast to the least dependent Brazil), thus facing a risk of trade volatility that could negatively influence these economies. Based on the findings, most exports from China, South Africa and Russia are concentrated on developed countries, while exports from India and Brazil are focused on developing markets. Regarding imports, apart from Russia, BRICS mostly import from developing markets. The study concludes that even though BRICS are emerging countries with their own problems, they can be complementary and could embrace a new growth model.

Another recent analysis on BRICS's trade with a focus on South Africa was conducted by Çakir and Kabundi (2011). Their research is based on shifts in South African trade linkages from the EU and US markets towards emerging economies of the south. Çakir and Kabundi apply the global VAR model[1] to examine the trade interactions and shock transmissions between South Africa and BRIC countries. The analysis shows export shocks from single BRIC countries having a positive effect on South African imports and output (China and India result in short-term impacts, while Brazil and Russia have long-term effects). Simultaneously, import shocks from Brazil and India also have a positive impact on South Africa. Overall, a smaller impact was observed for imports. Çakir and Kabundi also conduct the same analyses for BRIC as a single market. From this perspective, the results indicate positive export and import shocks to the South African economy but not to its output. The outcomes of the VAR analysis confirm the growing importance of trade relations between South Africa and the rest of the BRIC group.

Sharma and Kallummal (2012) investigate the higher level of trade relations among BRICS and the free trade agreement (FTA). The study tests the impacts of such an agreement made with BRICS and non-BRICS economies using the GTAP model[2] simulation. The removal of the import tariffs scenario would have an overall more or less positive effect on welfare and macroeconomic indicators for all BRICS. The impact on trade at the aggregate level shows positive signs for exports as well as imports for

[1] Vector Autoregressive model.
[2] Global Trade Analysis Project model.

BRICS and negative for non-BRICS regions. However, a higher positive change in imports than exports would result in a negative trade balance for all member countries apart from Russia.

The application of a complex general equilibrium method (AGE) and gravity model allows for another trade analysis approach between countries. The AGE model was used by Moktan and Miriyagalla (2008) for identifying the trade creation and trade diversion of SAFTA and SAFTA+5, while Kim (2002) examines the trade intensity among ASEAN+3 using the gravity model. Another recent work dealing with the trade issues of Brazil, India and China and the gravity model was also conducted by Kainulainen (2011).

3. Methodology and data

The following assessment of BRICS's geographical trade patterns is based on an evaluation of several trade indices. Concerning trade relations, several authors have investigated and proposed measurement indices within the past half decade and some of them are being applied in this paper. Firstly, BRICS's territorial export distribution is discussed, providing a general overview of the significance and development of BRICS's export to BRICS, the Triad and the rest of the world. In the next step, the assessment focuses on the export trade introversion of BRICS economies in order to define whether BRICS export more to other BRICS partners in comparison to the average level with the rest of the world. This is followed by the complementarity, RCA and regional orientation assessment.

3.1 Formulas

The trade intensity calculation between two countries was firstly used by Brown in 1949 and later applied by Kojima (1962). Iapadre (2004, 2006) further developed the measurement to intra and extra trade calculations, as well as to the introversion index, and expanded its use to regions and/or integration groups of countries in relation to the rest of the world.

The export trade introversion formula used in this paper is derived from the trade introversion index proposed by Iapadre. It shows trade intensity within the region in comparison to trade intensity with other countries out of the region. This index is defined as a subtraction of the homogeneous extra-regional trade intensity index from the homogeneous intra-regional trade intensity index divided by the sum of the homogeneous extra- and intra-regional trade indices:

$$TII_{ij} = \frac{[HI_{ij} - HE_{ij}]}{[HI_{ij} + HE_{ij}]}, \quad (1)$$

where H_{ji} and HE_{ij} are,

$$HI_{ij} = \frac{\frac{T_{ij}}{T_{iw}}}{\frac{T_{oj}}{T_{ow}}}, \quad (2)$$

$$HE_{ij} = \frac{[1 - \frac{T_{ij}}{T_{iw}}]}{[1 - \frac{T_{oj}}{T_{ow}}]}, \quad (3)$$

and where T_{ij} represents trade (exports plus imports) between reporting country i and partner country j; T_{iw} trade between reporting country i and the world (excluding country j); T_{oj} trade between the rest of the world (excluding country i) and country j; and T_{ow} trade between the rest of the world and the world.

After a modification to exports only, the index compares an intra-export intensity index with an extra-export intensity index to and from the examined group of countries. The advantage of the TII's index definition is the simplicity in which it can determine whether the intra-export or extra-export is dominant, and which one of them changes more rapidly. Since BRICS do not create a formal group of countries, the export introversion calculation in this paper is conducted not only for all BRICS, but also separately for each of the countries at a bilateral level.

Furthermore, trade relations are tested in the complementarity index. Again, it was Kojima and later Drysdale, and Drysdale and Garnanout (1982) who proposed this index. Even though it mostly provides only information about matching demands and supplies among countries, it helps with an identification of their trade potential and broadness of specialisation. This assessment thus enables a prediction of future trade relations among BRICS. For the purpose of this study, the complementarity was calculated between one BRICS country with the rest of the BRICS. The formula is as follows:

$$TCI = \left(1 - \sum_i \left[\left|\frac{\sum_w m_{iwd}}{\sum_w M_{wd}} - \frac{\sum_w x_{isw}}{\sum_w X_{sw}}\right| \div 2\right]\right) \times 100, \quad (4)$$

where d stands for the importing country of interest; s for the exporting country of interest; w for the set of all countries in the world; i for the set of industries; x for commodity export flows; X for total export flows; m for commodity import flows; and M for total import flows.

The TCI index ranges from 0 to 100, where 100 indicates the best match between partners' imports and exports. A limiting factor of TCI is the fact that it only reflects how well the exports and imports of the given countries match with each other. Therefore, it does not provide any information about real mutual trade but only implies whether or not there is a potential for trade. Moreover, mutual trade depends on a range of further conditions such as distance, trade barriers and so on.

In the last step, the identification of trade pattern inefficiencies is assessed by the examination of two

indices – the RCA and the regional orientation index (ROI).

RCA calculations stem from the widely used Balassa's index, the country's trade specialisation estimation, proposed by Balassa (1965). This index was also further elaborated on by Kunimoto (1977), Iapadre (2001) and Yeats (1997), who used a modified version. The RCA index is defined as a fraction where the export shares of commodity *j* by country *i* over the total exports of country *i* is the numerator, and export shares of the same commodity by the world to the total world's exports is the denominator:

$$RCA = \frac{\frac{x_{ij}}{x_i}}{\frac{x_{wj}}{x_w}}. \quad (5)$$

The variable x_{ij} is the export of commodity *j* by country *i;* x_i is the total export of country *i;* x_{wj} is the export of commodity *j* by the world; and x_w is the total export of the world.

The value of the fraction can reach from zero to infinity. While values in the range of zero to one indicate a comparative disadvantage, values above unity (neutrality) indicate a comparative advantage.

The ROI, employed by Yeats (1997), determines whether the exports of the examined country are more oriented towards the region rather than to other countries in the world. The ROI formula is defined as

$$ROI = \frac{\frac{\sum_d x_{isd}}{\sum_d X_{sd}}}{\frac{\sum_w x_{isw}}{\sum_w X_{sw}}}, \quad (6)$$

where x_{isd} represents the export of commodity *i* from country *s* into the block of countries *d*; X_{sd} total export from country *s* into the block of countries *d*; x_{isw} the export of commodity *i* from country *s* into the world (excluding block *d*); and X_{sw} stands for total export from country *s* into the world (excluding block *d*).

The ROI is computed among BRICS and the Triad and it can reach values from zero to infinity. All values bellow unity indicate export orientation out of the block of countries *d*, while values above unity mean orientation towards the block of countries *d*.

In a research paper from 1998, Yeats introduces a new approach for trade diversion identification and assesses MERCOSUR countries within the years 1988 to 1994. The results of the study are based on the calculations from the ROI and RCA. Yeats's main assumption stems from the opposite development of ROI (increasing) and RCA (decreasing). His assessment concludes trade diversion results for fast-growing product groups in MERCOSUR. The results were critically reviewed by Nagarajan (1998), who also incorporated the import side trade analysis into his research and took into consideration the technological content of products. However, the findings from his assessment were not in concordance with the results obtained by Yeats.

Trade diversion occurs under compliment with three conditions simultaneously:

$$(ROI_{t1} - ROI_{t0}) > 0 \wedge ROI_{t1} > 1 \wedge RCA_{t1} < 1, \quad (7)$$

where, t_0 and t_1 are years ($t_1 > t_0$).

The first condition indicates that the difference in the ROI within the two examined time periods must be higher than zero. That means positive regional export changes towards the examined region. The second condition defines the value of ROI at time t_1 to be higher than one. This indicates that the exports into the region of interest are higher than the average exports into other countries. Finally, the third condition identifies non-efficiency in production by showing the comparative disadvantage for an examined product group.

For the purpose of this study, the conditions hereof are modified to a symmetric version in order to be able to depict the result in cross charts:

$$(SROI_{t1} - SROI_{t0}) > 0 \wedge SROI_{t1} > 0 \wedge SRCA_{t1} < 0,$$

where,

$$SROI_x = \frac{ROI_x - 1}{ROI_x + 1} \quad (8)$$

$$SRCA_x = \frac{RCA_x - 1}{RCA_x + 1} \quad (9)$$

where *x* is the (examined) time period.

3.2 Data

The time period for the assessment was defined from 2001 to 2010. The year 2001 was chosen as a starting point when the newly coined term BRIC was defined by the investment bank Goldman Sachs. The analysis was finished in 2010, as there is no more updated data available for all the countries. The analysis was conducted for trade with goods only. The data were accessed from the International Trade Centre online database and information about tariffs from the World Trade Organization. Calculations were conducted for two-digit HS level product groups.

The limiting factor of the research is the focus on trade in goods since data for trade in services lack the statistics needed for the analysis and face difficulty determining trade barriers. Even though a share of services' exports in total BRICS exports is indispensable, within the past decade this has constituted around 10% (nearly unchanged) with the exception of India where the share has risen from one quarter to more than one third of India's total exports. In this case, the results for India in this study face more distortion than in other examined markets. Moreover, concerning services, the general estimated protection and impacts on BRICS's trade, in this case, would be rather coarse.

4. BRICS's export trends

Statistical trade data provide leading proof of the trends of increasing BRICS's exports. Overall, BRICS's exports, as a share of the world's exports, doubled from 8% (2001) to 16% (2010). Figure 1 shows the improvements in mutual BRICS's exports within the past decade. There has been a 4.3% and 5.3% increase in the share of BRICS's to BRICS exports and other countries in the world, respectively. On the contrary, during the same period, BRICS's exports to the Triad showed a 9.6% decline.

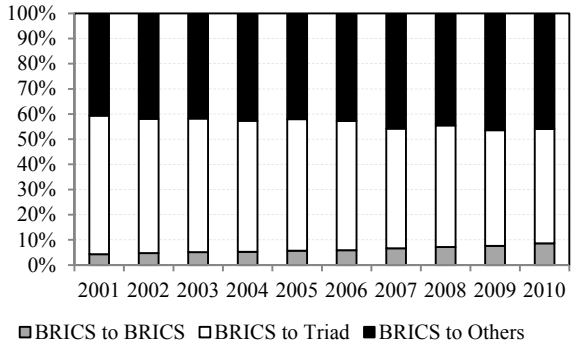

Figure 1 BRICS's territorial export distribution
Resources: International Trade Centre Database (2012)

The same trend changes, in territorial export distribution, as seen for the whole BRICS group, are also apparent in Figure 2 for each of the BRICS economies separately. The biggest share increase in exports to BRICS was recorded by Brazil (13.7%) and South Africa (12.6%) with a minor increase from India (6.6%) and China (4%). Russia is the only exception with nearly no export increases (0.2%) to BRICS.

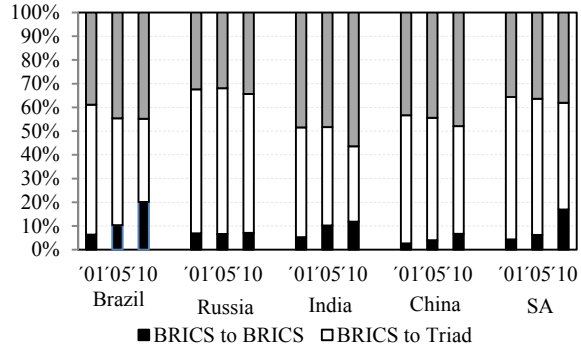

Figure 2 Single BRICS's Territorial Export Distributions
Resources: International Trade Centre Database (2012)

As the weight of exports for some product groups in total BRICS's exports is rather insignificant, a further assessment analysis investigates only the top 10 product groups with the largest values of exports (in millions of USD). The share of BRICS's top 10 product group exports accounts for 62.7% of BRICS's total world exports. Moreover, within the examined time period (2001 to 2010), all of them have recorded an increase in absolute terms. The export trends observed above for BRICS's total exports are also similar for BRICS's top 10 export product groups. BRICS's top 10 export product groups to the Triad constitutes a 4.8% decrease, which is compensated by export growth from BRICS to BRICS (3.7%) and BRICS to Others (1.1%). Thus, it is obvious that the greater decline of total BRICS's exports to the Triad (nearly 12%) was recorded particularly by less significant product categories.

BRICS's export introversion index (EII) and the intra and extra exports' indices provide further insights into BRICS's trade relations (presented in Figure 3). From the previous discussion and EII results, it is obvious that BRICS's mutual trade growth does not imply an increase in intensity among BRICS. The low value of the EII does not confirm the assumption of closer trade integration among BRICS. BRICS's intra export is largely overtaken by its extra export index. Nevertheless, a weak tendency towards closer cooperation has become slightly evident since 2006 when the intra export index started to grow at a faster rate than the extra export index.

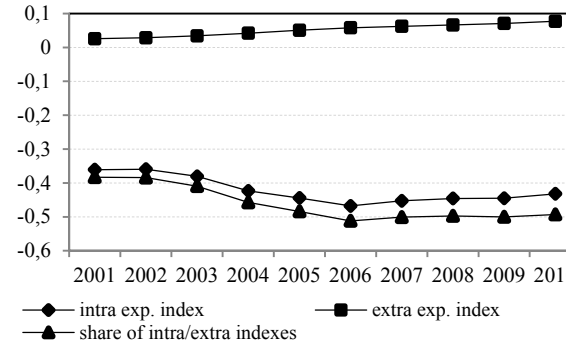

Figure 3 Total BRICS's EII
Resources: International Trade Centre Database (2012)

Since there is no effective PTA among BRICS, BRICS's EII shows a rather high independent behaviour in BRICS economies for this matter. Therefore, the following bilateral export intensities analysis examines each of the BRICS countries separately. (The evolution of the EII between BRICS and partners is shown in Figure 14 in the Appendix).

The export intensities of Brazil to BRICS (except India, which is neutral) are at a higher level than the average export intensities of Brazil to the world. This is particularly caused by intensifying trade ties between Brazil and China in recent years. On the contrary, export intensities with the Triad remain below the average. The intensity of Brazil trade with the US has decreased from being higher than average to lower than average since 2008. During the crisis, this trend was even more distinctive. Simultaneously, there was

a sharp increase in trade intensity with India, indicating trade reorientation.

Russia's export intensity in the long run was disclosed as unchanged and above average with the EU, its significant trade partner. This is particularly given by Europe's continuing dependency on gas and oil supplies. Other examined markets showed a lower than average export intensity. Yet, the intensity with India showed a rise during the crisis in 2008.

India's EII with the Triad was below average and showed declining trends. Such a trend goes along with the Indian strategy of reorientation from the Triad to other, mainly Asian, trade partners. A major increase in the EII was recorded between India and Brazil, resulting in an EII change from below average to above average. Contrary development to that for Brazil was recorded for Russia. This trend is in concordance with the findings of Yuan and Zhao (2011), who conclude that Russia, the only one out of BRICS, imports more from developed markets than from developing economies.

The EII calculations for China and its partners showed an increasing tendency with all examined markets but two, Russia and Japan. Only the EII with the EU remained below zero but improved within the past decade. Apart from the EU, the intensities are converging, namely the intensity of Chinese exports to these markets is very striking (export diversification is uniform). The low intensity with the EU indicates that the EU provides a potential future market for Chinese exports.

South Africa's EII with Japan and India has been rising while maintaining above average. The largest growth was recorded for China, changing from a negative to a positive value. An EII decline was seen for the EU and Brazil while being below average at the same time. Russia has also been below average but has increased in recent years and the US has remained unchanged. The previous analysis showed that the bilateral EII results are rather ambiguous, being disturbed mainly by Russia and partially by South Africa.

Apart from the EII, the conducted complementarity tests provide a useful tool to indicate future trade arrangements among BRICS. The complementarity index used in this study stems from the calculation between one country and the rest of the BRICS's group (see Table 1). Further complementarity tests found some signs of improvements for this index only among India and the BRICS's group, indicating higher trade profile compatibility. Brazil's complementarity evolution, as a partner of BRICS, has remained nearly unchanged. The remaining partners' (Russia, China and South Africa) complementarity evolution has been slightly deteriorating. Thus, the results are again rather ambiguous. Moreover, the declining complementarity trend (for all BRICS excluding India) can be a result of production specialisation.

Table 1 BRICS's complementarity

Country	Brazil		Russia		India		China		SA	
Year	'01	'10	'01	'10	'01	'10	'01	'10	'01	'10
TCI	52.9	52.1	38.9	35.9	47.1	56.5	55.1	53.4	55.5	52.8

Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

By comparison, the TCI results obtained from the UNESCAP database (2001–2007) for the already existing regional trading blocs, e.g. APTA, SAFTA and BIMSTEC,[3] where the largest BRICS countries China and India are members, range on average from 51.6 to 67.5. Therefore, it can be assumed that TCI > 50 for the majority of the BRICS countries indicates a potential for further trade arrangements among BRICS.

5. BRICS's regional orientation

Even though the share of BRICS to BRICS exports has been increasing, the Triad still plays a major role from a volume perspective. The focus in the following part of the paper is oriented to the observation of whether some regional orientation changes and trade diversions of BRICS to BRICS from the Triad have occurred. The assessment further continues with a closer analysis of the top 10 export product groups of each of the BRICS, based on volume (in USD) and the identification of possible trade diversions (according to equations 7 and 8). Table 6 in the Appendix includes a list of the top 10 export product groups for each of the BRICS, their export shares and changes from 2001 to 2010. Furthermore, the table contains ROI calculations and index changes for the examined period. The same is calculated for RCA. The last column shows whether a particular product group complies with the defined condition for trade diversion. The following text provides a more detailed description of each of the economies.

The top 10 export products in *Brazil* constitute a share of 65.1% of total exports. The ROI results for the product categories 26, 27, 17, 02 and 12 were above unity, which indicates stronger orientation towards BRICS in comparison to the Triad. Some improvements in ROI are apparent for categories 72, 09 and 23. On the contrary, product group 84 recorded worsening ROI results. However, there were two product groups where ROI monitored major changes.

[3] APTA, South Asian Free Trade Area (SAFTA), Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC).

While ROI for 87 was higher than unity in 2001, nearly 10 years later, it belonged to a group with ROI below unity. This indicates a loss of regional orientation in BRICS markets. However, a much better improvement in ROI can be witnessed for category 27, where ROI exceeded unity, and thus there was a sign for reorientation towards BRICS in 2010.

A detailed division of the top 10 export product groups is illustrated in Figure 4. The product groups listed in QI and QII are those oriented to BRICS markets. From an export perspective, QI is most effective to BRICS regions, while the product groups in QII, even though still quite effective, show a declining tendency. On the other hand, QIV shows perspective exports with improving ROI; nevertheless, it is still more outward-oriented. Finally, QIII consists of ineffective exports with worsening ROI trends.

The next step for identifying the effectiveness of BRICS's exports is the analysis of their RCAs. Figure 5 provides an overview of the calculated RCAs for the top 10 export product groups. The assessment results showed in QI contain product groups with RCAs above zero, indicating a comparative advantage in the production of the particular product together with an improving RCA within the examined time period. QII lists product groups with RCAs above zero, however with a worsening trend. The QIII and QIV area includes all top 10 export product groups with a comparative disadvantage, i.e. their RCA indices take values below zero. As for Brazil, the following three top 10 export product categories (27, 87 and 84) are produced with a comparative disadvantage.

The product groups with trade diversion effects are defined as those with positive changes in ROI within the examined time period. In addition, the ROI must be higher than zero and the country must show a comparative disadvantage in the production of a particular product category (according to equations 7 and 8). The assessment of Brazilian exports showed one product group (group 27) that meets the criteria hereof. The product category 27 – *Mineral fuels, oils, distillation products, etc.* – is the second most exported group of products oriented towards BRICS markets, although it is not competitive enough to have a comparative advantage in this production. Most exports, as presented in Table 2, are oriented towards India (23.6%) and China (76.3%) where exports increased, while Russia remained nearly unchanged and exports for South Africa declined (being around 0%).

Russia's top 10 exports make up 88.8% of total exports. Based on the ROI results, presented in Figure 6, the categories oriented towards BRICS markets are 31, 44 and 84. An improving ROI was identified for 27, 71, 28, 44, 84 and 75. A declining ROI, but still holding a value above zero, was a characteristic for 72 and 76. There was a shift in regional orientation for product group 72 from BRICS markets towards the Triad.

Table 2 Brazilian exports of *27 – mineral fuels, oils, distillation products, etc.* to BRICS

Country	Russia		India		China		SA	
Year	2001	2010	2001	2010	2001	2010	2001	2010
Exports to BRICS (%)	0.0	0.0	0.1	23.6	55.6	76.3	44.4	0.1

Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

The following categories, displayed in Figure 7, are produced by Russia without a comparative advantage: 71, 44, 84 and 75.

Only two groups from the top 10 Russian HS2 exports fulfil the criteria for trade diversion: *44 – Wood and articles of wood, wood charcoal* and *84 – Machinery, nuclear reactors, boilers, etc*. Table 3 shows that exports from group 44 are primarily oriented to China (nearly 100%) and have remained unchanged within the past decade. Exports from product group 84 to Brazil (0.2%) and South Africa (0.1%) are insignificant, whereas exports to China (59%) declined and exports to India (40.7%) nearly doubled between 2001 and 2010.

Table 3 Russian exports of *84 – machinery, nuclear reactors, boilers, etc.* and *44 – wood and articles of wood, wood charcoal* to BRICS

Country	Brazil		India		China		SA	
Year	2001	2010	2001	2010	2001	2010	2001	2010
84's Exports to BRICS (%)	0.9	0.2	17.3	40.7	81.7	59.0	0.15	0.1
44's Exports to BRICS (%)	0.0	0.0	0.1	0.2	99.9	99.8	0.0	0.0

Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

The ROI for the top 10 *Indian* exports, constituting 60% of total exports**,** shows only negative changes over time with two exceptions. Categories 26 and 52 are oriented outward from the Triad. Nevertheless, the current situation is different in comparison to 2001. Product groups 27, 29 and 72 were oriented in 2001 towards BRICS. However, in 2010, their ROIs indicated changing patterns and an orientation towards Triad markets (see Figure 8).

The RCA results, presented in Figure 9, indicate that India produces categories 71, 85 and 72 with a comparative disadvantage. However, none of the top 10 exports complies with the trade diversion criteria.

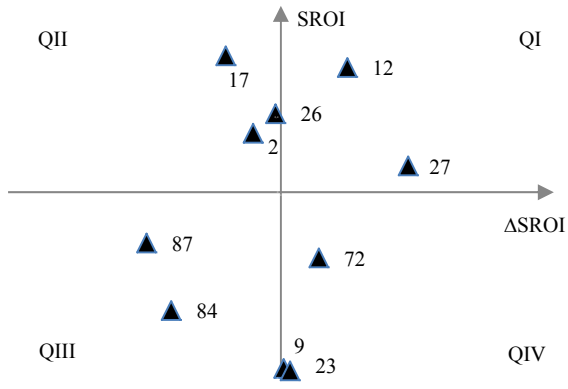

Figure 4 ROI for the top 10 Brazilian exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

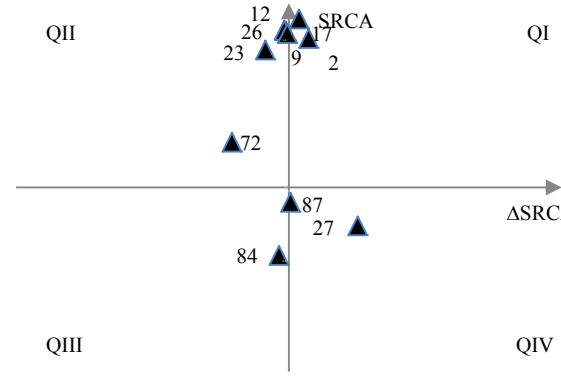

Figure 5 RCA for the top 10 Brazilian exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

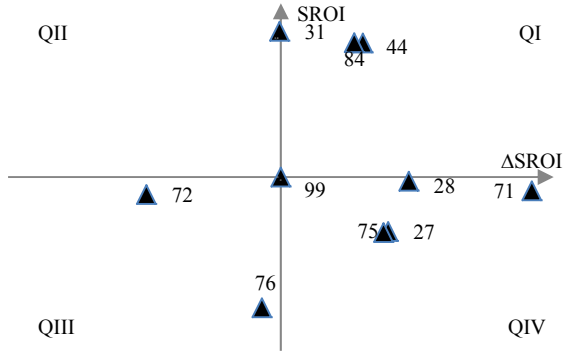

Figure 6 ROI for the top 10 Russian exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

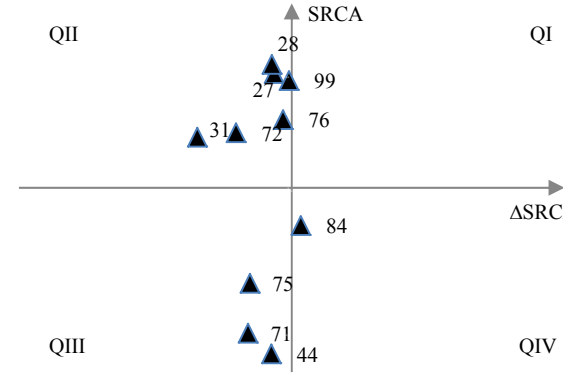

Figure 7 RCA for the top 10 Russian exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

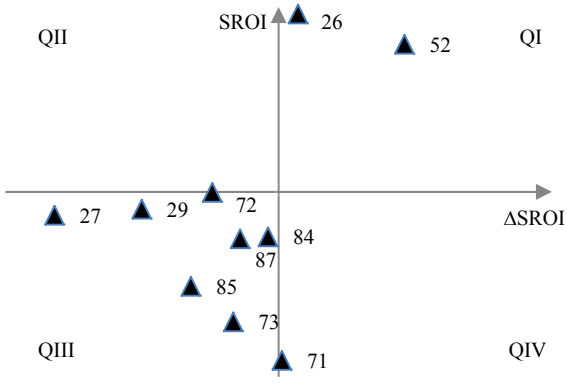

Figure 8 ROI for the top 10 Indian exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

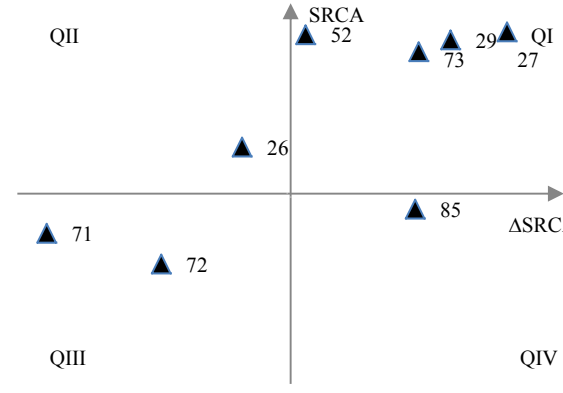

Figure 9 RCA for the top 10 Indian exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

China's top 10 exports represent 68.2% of total Chinese exports. According to the ROI calculations, illustrated in Figure 10, the product groups 90, 73, 87 and 64 are oriented towards BRICS. A worsening ROI was computed for categories 61, 62 and 64. The rest of the top 10 exports showed an improving ROI within the past decade. The export reorientation is apparent for four product groups. While product group 62 showed a reorientation from BRICS markets towards

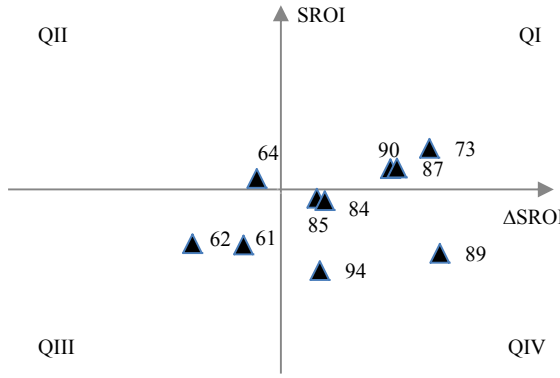

Figure 10 ROI for the top 10 Chinese exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

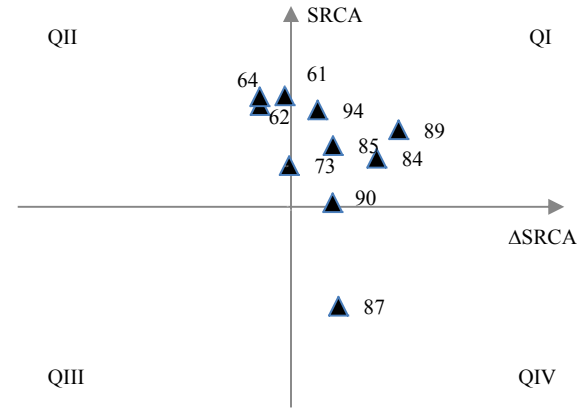

Figure 11 RCA for the top 10 Chinese exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

the Triad, export groups 73, 87 and 89 witnessed the contrary relocation.

In 2010, China only produced category 87 from the top 10 with an RCA below zero, as observed in Figure 11.

The same product group *87 – Vehicles other than railway, tramway* – was also the only group that showed a trade diversion. Table 4 shows that exports to Brazil (28.2%) increased by 8% and exports to Russia (32.7%) and India (26%) doubled. On the contrary, exports to South Africa declined by two thirds to 13.2%.

Table 4 Chinese exports of *87 – vehicles other than railway, tramway* to BRICS

Country	Brazil		Russia		India		SA	
Year	2001	2010	2001	2010	2001	2010	2001	2010
Exports to BRICS (%)	20.7	28.2	16.6	32.7	10.5	26.0	45.2	13.2

Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

South Africa's top 10 exports (77.1%) show a larger orientation towards BRICS for categories 26 and 27. The improving ROI is characterised only for 71, 26 and 27 (see Figure 12).

An RCA below zero, presented in QIII and QIV in Figure 13, is a characteristic for groups 27, 84, 85 and 29.

Criteria for a trade diversion are fulfilled by one of the top 10 exported product groups: *27 – Mineral fuels, oils, distillation products, etc.* There was a dramatic decline, by nearly 30%, in this category of exports to Brazil, currently 4.9% (see Table 5). The decrease in exports to Brazil was substituted by an increase in exports to India (73.6%) and China 21.5%. Exports to Russia remained nearly at zero.

Table 5 South Africa exports of *27 – mineral fuels, oils, distillation products, etc.* to BRICS

Country	Brazil		Russia		India		China	
Year	2001	2010	2001	2010	2001	2010	2001	2010
Exports to BRICS (%)	33.8	4.9	0.1	0.0	61.2	73.6	4.5	21.5

Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

Even though there are more than three trade diverting product groups out of 99 (see Table 7 in the Appendix) for each of the BRICS, their shares of total exports are rather minor. Thus, they are not relevant for this study. Furthermore, some of the trade diverting product groups from the top 10 exports identified above also show relatively small shares in total exports e.g. those for Russia (1.4% and 1.6%) and China (2.4%). Hence, the only trade diverting product categories in regard to their export significance are recorded for Brazil and South Africa in category *27 – Mineral fuels, oils, distillation products, etc.* The main importers for category 27 from BRICS are China and India. Their import shares of *Mineral fuels, oils, distillation products, etc*. from Brazil and South Africa grew from 2% to 21%, while dropping for the Triad from 58% to 35% from 2001 to 2010.

6. BRICS's applied tariffs

Generally, trade diversion usually occurs as a result of a PTA accompanied by tariff cuts and the preferential treatment of PTA partners at the expense of non-members. Right now, there has been no existing single PTA covering all BRICS. Nevertheless, the explanation of trade patterns can be partially found in changing tariff levels. In spite of world trade liberalisation,

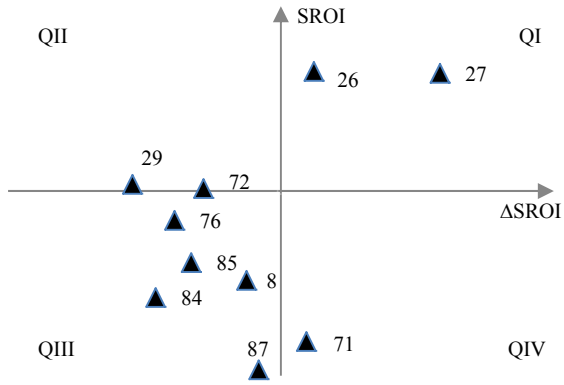

Figure 12 ROI for the top 10 South African exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

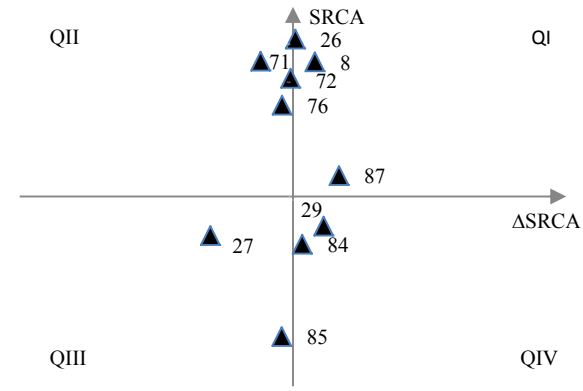

Figure 13 RCA for the top 10 South African exports
Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

applied tariff levels in given countries are still influential since tariff peaks for selected sensitive product groups could play an important role in trade distortion. Even though BRICS have carried out major tariff cuts, their averages are still higher than those for developed Triad markets. This is naturally the result of a generalised system of preferences applied by developed nations towards developing and emerging countries. Trade liberalisation in BRICS was mainly induced by the crises in the 1990s. This is particularly true for Brazil, Russia (with mixed results) and India. On the contrary, liberalisation in China has been continuing since its reforms at the end of the 1970s, as China has not yet witnessed either an economic or a financial crisis. Nevertheless, the recent global economic and financial crisis has resulted in some of the countries increasing protectionist behaviour. As a result, according to Sally (2009), Brazil raised its tariffs on selected steel products and kept tariffs high on intermediate products. Moreover, Russia witnessed non-liberalising tendencies and increasing tariffs on transportation products, steel, flat screen TV panels and agricultural products. The food and light industry belongs to one of the most protected areas in Russia today. India, one of the least open economies of the BRICS, also applies protectionist measures on agriculture, industrial products, intermediate inputs and consumer goods. On the contrary, China orients market protection more towards the service sector rather than towards goods. South Africa applies the lowest simple average tariff (7.6%) of all BRICS. Its main protection focuses on industrial goods and manufactured products, among which belong garments, automobiles and steel (Sally, 2009).

The different levels of applied import tariffs on mineral fuels, oils and distillation products in China and India and the Triad are shown in Table 8 in the Appendix. The diversion of the HS27 product group thus reflects the declining tariffs in India and China. This is a result of trade liberalisation, as well as the increasing demand for mineral fuels, oils and distillation products in the two large Asian economies as its supply is necessary for the further enhancement for their economic growth.

However, existing relations can be influenced by further liberalisation, newly concluded PTAs, and/or Russia's recent WTO accession and changes in other parts of the world. Furthermore, it is important to note that many other factors (such as the proximity of markets, employment of modern technology) do not reflect the reality in the previous calculations (complementarity, RCA) but can influence real trade relations.

7. Conclusion

The growing importance of BRICS emerging markets is reflected in their increasing shares of the world's exports. Current statistics show that BRICS's export shares towards BRICS and to other world markets are rising at the expense of shrinking export shares to the Triad. BRICS's mutual exports have recorded some improvements, which could imply closer trade cooperation between BRICS. Nevertheless, the results indicate that BRICS's exports to non-Triad markets consist of less significant product groups in terms of value.

Furthermore, the export trends of single BRICS trade partners differ (sometimes are even contradictory). Therefore, at this time it is not possible to simply define an unambiguous conclusion for BRICS as a group. The export intensity assessment showed reorientation from the Triad to other markets for Brazil and India. Both countries reported higher than average export intensities with each other. South Africa recorded positive export intensities with Asian economies, while Russia showed above average intensities with the EU and the opposite is true for

China and the EU. The BRICS group's export introversion indicator disclosed a lower than average intensity among BRICS in comparison to the intensity of the BRICS with the rest of the world, although its trend has been slightly improving. The export intensity assessment provided evidence that BRICS's current behaviour seems to be rather independent and is a result of several bilateral relations rather than a development of export intensities among BRICS as a group. These findings thus do not provide firm confirmation of the assumption of closer trade integration among all BRICS markets within the past decade.

Testing the complementarity showed a worsening indicator for all BRICS but India. However, their levels do not change too much from already existing integration groups (e.g. those in Asia), which can be interpreted as a production specialisation of BRICS and increasing trade profile compatibility between India and the BRICS group.

Based on ROI and RCA calculations, there were identified product groups with possible trade inefficiencies reflecting changes in global trade shifts. Trade diversion from the Triad to BRICS was identified for all countries but with different significances. From the export significance point of view, three product categories from the BRICS's top 10 exports show trade diversion from the Triad to BRICS. The most significant is, however, category *27 – Mineral fuels, oils, distillation products, etc.* – being exported by Brazil and South Africa, which shows the major diversion from the US and EU markets towards China and India. This is a result of trade liberalisation as well as increasing demand from these two Asian economies.

The assessment covered in this paper provides a basis for further BRICS trade analysis elaborating on other areas influencing trade relations such as the proximity of markets and employment of modern technology. In the future, it can be expected that further tariff cuts and the elimination of non-tariff barriers applied either unilaterally or those based more on bilateral agreements such as APTA or FTA agreements among BRICS and the Triad may play more of an important role in future trade relations and the efficiency of trade between partners.

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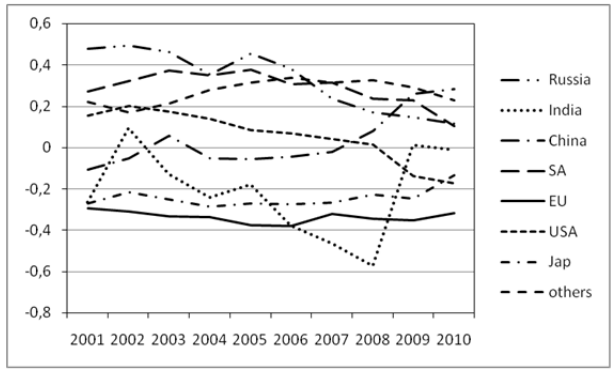
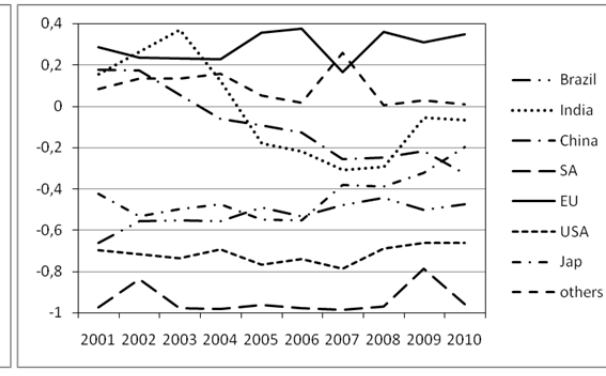
Appendix

Figure 14 The evolution of the EIIs between BRICS single economies and their partners

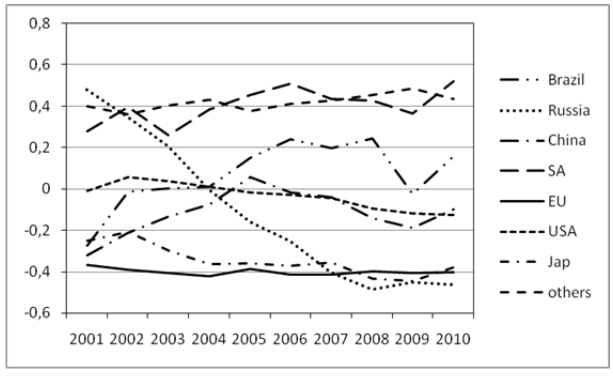
Brazil – Partners



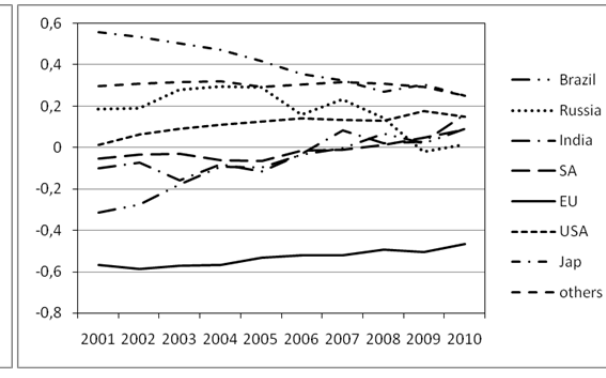
Russia – Partners



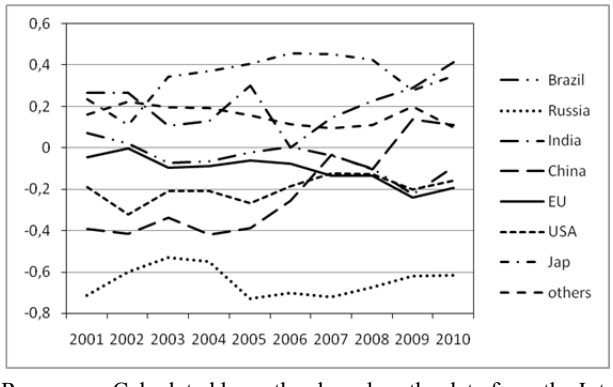
India – Partners



China – Partners



SA – Partners



Resources: Calculated by author based on the data from the International Trade Centre Database (2012)

Table 6 Top 10 export product groups for each of the BRICS, their export shares, and changes from 2001 to 2010, ROI, RCA, their index changes and trade diversion

Top 10 Brazilian Exports		Export (in USD)		Export Increase		ROI			RCA			Trade Diversion
HS2	Product Group	2001	2010	Absolute	%	2001	2010	Change	2001	2010	Change	
'26	Ores, slag and ash	3128625	30839053	27710428	986	2.6	2.5	–0.1	13.3	12.3	–1.1	no
'27	Mineral fuels, oils, distillation products, etc	2092496	19842978	17750482	948	0.5	1.3	0.8	0.4	0.7	0.3	yes
'17	Sugars and sugar confectionery	2401080	12951279	10550199	539	29.0	6.5	–22.5	15.3	22.3	7.0	no
'87	Vehicles other than railway, tramway	4427345	12090630	7663285	273	1.6	0.6	–1.0	0.8	0.9	0.1	no
'02	Meat and edible meat offal	2552739	11877543	9324804	465	2.4	1.9	–0.5	6.6	9.4	2.8	no
'12	Oil seed, oleagic fruits, grain, seed, fruit, etc, nes	2756980	11175427	8418447	405	2.5	5.0	2.5	14.3	12.5	–1.8	no
'84	Machinery, nuclear reactors, boilers, etc	4241830	10885709	6643879	257	0.6	0.2	–0.4	0.5	0.5	0.0	no
'72	Iron and steel	2846741	8385692	5538951	295	0.3	0.5	0.2	2.7	1.7	–1.0	no
'09	Coffee, tea, mate and spices	1339977	5397542	4057565	403	0.0	0.0	0.0	11.5	11.1	–0.4	no
'23	Residues, wastes of food industry, animal fodder	2165331	5037971	2872640	233	0.0	0.0	0.0	10.8	6.9	–4.2	no

Top 10 Russian Exports		Export (in USD)		Export Increase		ROI			RCA			Trade Diversion
HS2	Product Group	2001	2010	Absolute	%	2001	2010	Change	2001	2010	Change	
'27	Mineral fuels, oils, distillation products, etc	51860985	261850121	209989136	505	0.2	0.5	0.3	5.3	4.3	–1.0	no
'99	Commodities not elsewhere specified	12356012	29076723	16720711	235	0.1	N/A	N/A	3.9	3.8	–0.1	N/A
'72	Iron and steel	5547426	19085705	13538279	344	2.3	0.8	–1.5	3.0	1.9	–1.1	no
'31	Fertilizers	1675983	7388901	5712918	441	11.8	11.4	–0.4	4.3	1.8	–2.5	no
'71	Pearls, precious stones, metals, coins, etc	1137864	7301349	6163485	642	0.0	0.9	0.9	0.2	0.1	–0.1	no
'76	Aluminium and articles thereof	4434908	6834781	2399873	154	0.2	0.1	–0.1	2.3	2.2	–0.1	no
'28	Inorganic chemicals, precious metal compound, isotopes	940837	6479444	5538607	689	0.3	1.0	0.7	6.8	5.1	–1.7	no
'44	Wood and articles of wood, wood charcoal	2463613	6220529	3756916	252	2.8	7.8	5.0	0.1	0.1	0.0	no
'84	Machinery, nuclear reactors, boilers, etc	3314812	5655713	2340901	171	3.0	7.8	4.8	0.6	0.7	0.1	yes
'75	Nickel and articles thereof	1123018	5423618	4300600	483	0.2	0.5	0.3	0.5	0.3	–0.2	no

Top 10 Indian Exports		Export (in USD)		Export Increase		ROI			RCA			Trade Diversion
HS2	Product Group	2001	2010	Absolute	%	2001	2010	Change	2001	2010	Change	
'27	Mineral fuels, oils, distillation products, etc	2147820	37984132	35836312	1768	5.5	0.8	–4.7	1.1	12.3	11.2	no
'71	Pearls, precious stones, metals, coins, etc	7018818	32464564	25445746	463	0.0	0.1	0.1	5.3	0.7	–4.6	no
'87	Vehicles other than railway, tramway	871642	9285872	8414230	1065	0.8	0.6	–0.2	0.6	22.3	21.7	no
'85	Electrical, electronic equipment	1321087	8706451	7385364	659	0.7	0.3	–0.4	0.3	0.8	0.5	no
'29	Organic chemicals	1624657	8592662	6968005	529	2.4	0.8	–1.6	1.6	9.4	7.8	no
'84	Machinery, nuclear reactors, boilers, etc	1582696	8149768	6567072	515	0.7	0.6	–0.1	0.3	12.5	12.2	no
'72	Iron and steel	919366	6996228	6076862	761	1.6	1.0	–0.6	1.2	0.5	–0.7	no
'26	Ores, slag and ash	512644	6908762	6396118	1348	17.4	52.5	35.1	2.5	1.7	–0.8	no
'52	Cotton	2126177	6889856	4763679	324	2.0	8.9	6.9	8.1	11.1	3.0	no
'73	Articles of iron or steel	1038460	6367666	5329206	613	0.3	0.2	–0.1	1.8	6.9	5.1	no

Top 10 Chinese Exports		Export (in USD)		Export Increase		ROI			RCA			Trade Diversion
HS2	Product Group	2001	2010	Absolute	%	2001	2010	Change	2001	2010	Change	
'85	Electrical, electronic equipment	51299483	388755010	337455527	758	0.7	0.9	0.2	1.4	1.9	0.5	no
'84	Machinery, nuclear reactors, boilers, etc	33579011	309813672	276234661	923	0.6	0.9	0.3	0.9	1.6	0.7	no
'61	Articles of apparel, accessories, knit or crochet	13455949	66710933	53254984	496	0.7	0.5	–0.2	3.7	3.5	–0.2	no
'62	Articles of apparel, accessories, not knit or crochet	18952050	54361478	35409428	287	1.1	0.5	–0.6	4.2	3.0	–1.2	no
'90	Optical, photo, technical, medical, etc apparatus	6445848	52109780	45663932	808	0.6	1.3	0.7	0.8	1.0	0.2	no
'94	Furniture, lighting, signs, prefabricated buildings	7559205	50584032	43024827	669	0.3	0.4	0.1	2.3	2.9	0.6	no
'89	Ships, boats and other floating structures	1927691	40296396	38368705	2090	0.0	0.5	0.5	1.0	2.2	1.2	no
'73	Articles of iron or steel	6012422	39143621	33131199	651	0.5	1.6	1.1	1.5	1.5	0.0	no
'87	Vehicles other than railway, tramway	4777141	38397962	33620821	804	0.5	1.3	0.8	0.2	0.3	0.1	yes
'64	Footwear, gaiters and the like, parts thereof	10095770	35633851	25538081	353	1.4	1.1	–0.3	4.9	3.4	–1.5	no

Top 10 S.A. Exports		Export (in USD)		Export Increase		ROI			RCA			Trade Diversion
HS2	Product Group	2001	2010	Absolute	%	2001	2010	Change	2001	2010	Change	
'71	Pearls, precious stones, metals, coins, etc	5219510	11801431	6581921	226	0.1	0.1	0.0	10.8	6.0	–4.8	no
'26	Ores, slag and ash	1064888	9784733	8719845	919	3.2	4.7	1.5	10.2	10.8	0.6	no
'72	Iron and steel	2117161	7929536	5812375	375	1.8	1.0	–0.8	4.4	4.3	–0.1	no
'27	Mineral fuels, oils, distillation products, etc	3068529	7223353	4154824	235	1.1	4.5	3.4	1.2	0.7	–0.5	yes
'87	Vehicles other than railway, tramway	2096383	6437205	4340822	307	0.1	0.0	–0.1	0.9	1.3	0.4	no
'84	Machinery, nuclear reactors, boilers, etc	2106830	5126963	3020133	243	0.8	0.3	–0.5	0.6	0.6	0.0	no
'08	Edible fruit, nuts, peel of citrus fruit, melons	543887	2120292	1576405	390	0.5	0.4	–0.1	4.4	5.9	1.5	no
'76	Aluminium and articles thereof	860260	1986506	1126246	231	1.6	0.7	–0.9	3.2	2.9	–0.3	no
'85	Electrical, electronic equipment	658588	1413290	754702	215	0.9	0.4	–0.5	0.2	0.2	0.0	no
'29	Organic chemicals	363297	1293570	930273	356	3.8	1.1	–2.7	0.6	0.7	0.1	no

Resources: Calculated by author based on data from the International Trade Centre Database (2012)

Table 7 Trade diverting product groups for each of the BRICS of the total of 99, their shares in total country's exports, trade diverting product groups from the top 10 exports, their shares in total exports and destination country

Exporting country	Total number of diverting groups	Share of diverting groups in total country's exports (%)	Export share of top 10 (%)	Diverting HS product category from top 10 exports and their share in total country's exports (%)		Importing Country
Brazil	3	10.4	65.1	27 – Mineral fuels, oils, distillation products, etc.	10.1	China, India
Russia	26	6.6	88.8	84 – Machinery, nuclear reactors, boilers, etc.	1.4	China, India
				44 – Wood and articles of wood, wood charcoal	1.6	China
India	4	0.5	60.0	N/A	N/A	N/A
China	17	9.4	68.2	87 – Vehicles other than railway, tramway	2.4	Russia, India, Brazil
SA	9	12.5	77.1	87 – Vehicles other than railway, tramway	10.1	India, China

Resources: Calculated by author based on data from the International Trade Centre Database (2012)

Table 8 The applied import tariffs for trade diverting product groups

Country	Brazil		Russia		India		China		SA		USA		EU		Japan	
Year	2001	2010	2001	2010	2001	2008	2001	2008	2001	2010	2001	2010	2001	2010	2001	2010
Tariff lines average (%)	13.3	11.6	10.3	N/A	31.7	12.7	15.9	9.7	6.2	7.6	5.4 (3.9)	4.0 (2.6)	4.8	4.6	4.9 (3.7)	4.6 (3.1)
Average for 27 (%)	0.6	0.4	5.0	N/A	20.9	8.7	6.6	5.6	4.4	4.0	0.8 (0.3)	0.7 (0.4)	1.9	1.4	1.3 (0.7)	1.1 (0.6)
Average for 84 (%)	13.4	11.5	N/A	N/A	23.4	6.9	13.8	7.8	2.4	2.5	1.3 (0.1)	1,3 (0.1)	1.7	1.9	0.0 (0.0)	0.0 (0.0)
Average for 87 (%)	22.4	22.1	10.6	N/A	48.4	37.6	N/A	N/A	13.0	11.0	2.7 (1.9)	2.5 (1.8)	6.4	6.3	0.1 (0.0)	0.1 (0.0)
Average for 44 (%)	10.1	8.1	N/A	N/A	27.8	9.0	8.7	3.8	7.5	6.9	2.1(0.3)	2.0 (0.2)	2.8	2.3	2.9 (1.5)	3.4 (2.0)

Resources: WTO (2012)